AMENDMENT TO THE SPECIFICATIONS

▪ Please replace the first full paragraph on page 3, lines 1-27, with the following rewritten version:

"Bayesian reconstruction methods have been applied to numerous problems in a wide variety of fields. In their standard form, however, they can be very computationally intensive, since they generally require the numerical maximization of a complicated function of many variables. For example, in image reconstruction problems, it is not unusual for the number of variables to be [[˜]] $\simeq 10^6$. Furthermore, one of the most popular Bayesian reconstruction algorithms is the maximum-entropy method (MEM), which can only be applied to the reconstruction of the signals that are strictly non-negative (see below). The method can, however, be extended to signals that can take both positive and negative values. We develop the MEM approach so that is can be applied to the reconstruction of signals that can take positive, negative or complex values. As a result, this enables the use of similarity transformations in the reconstruction algorithm so that calculations can be performed in an alternative "basis" this is more appropriate to the problem under consideration. Specifically, the basis is chosen so that signal is reconstructed by performing a large number of numerical maximization of low dimensionality, rather than a single maximization of high dimensionality. This results in a significant increase in speed. Indeed, the example outlined below, the speed of the reconstruction algorithm is increased by a factor of about 100."

▪ Please replace equation (1) on page 4, line 21, with the following rewritten version:

$$d = \phi(s) + [[\epsilon]]\ \underline{\in}$$

▪ Please replace the first full paragraph on page 5, lines 3-11, with the following rewritten version:

"The likelihood function describes the statistics of noise contribution [[ϵ]] $\underline{\epsilon}$ to the data. This function may take any form appropriate to the noise statistics. It is convenient to define the log-likelihood function L(s) = In [Pr (d | s)] so that the likelihood function may be written as Pr (d | s) = exp[L(s)]. As an example, if the noise on the data is Gaussian-distributed and described by the noise covariance matrix N, then the likelihood function takes the form"

▪ Please replace the first full paragraph on page 6, lines 1-13, with the following rewritten version:

"It is clear, however, that although the noise contribution [[ϵ]] $\underline{\epsilon}$ to the data may often be Gaussian-distributed, the assumption of a Gaussian form for the prior is not valid for a general signal. If the joint probability distribution of the elements of the signal vector is know then is should be used as the prior. This is almost always impossible, however, and we instead investigate the assignment of a prior applicable to general signs that is based on information-theoretic considerations alone. Using very general notions of subset independence, coordinate invariance and system independence, it may be shown that the prior probability Pr (s) should take the form"

▪ Please replace the first full paragraph on page 7, lines 6-17, with the following rewritten version:

"The maximum-entropy method has been applied to a wide range of signal reconstruction problems. In its standard form, however, it can be very computationally intensive. The function F (s) is in general a complicated function of the components s_n of the signal vector and so a numerical maximization of the F (s) must be perform over this N_S-dimensional space. It is not unusual for N_S to be of the order N_S [[~]] $\simeq 10^6$, particularly in image reconstruction problems. Moreover, the standard MEM approach is only applicable to

signals that are strictly non-negative, as is clear from the presence of the logarithmic term in the expression (4) for the entropy."

▪ Please replace the first full paragraph on page 10, lines 1-3, with the following rewritten version:

"Since the noise vector [[ϵ]] $\underline{\epsilon}$ also belongs to the data space a similar change of basis can apply to it, such that"

▪ Please replace the third full paragraph on page 10, lines 15-20, with the following rewritten version:

"Once we have performed the changes of basis in the data and signal spaces, we denote the vectors with components s'_n by s' and we similarly define the vectors d' and [[ϵ']] $\underline{\epsilon'}$ as those containing the elements d'_n and [[ϵ'_n]] $\underline{\epsilon'_n}$ respectively. In the signal space we can relate the two bases $e^{(n)}$ and $e'^{(n)}$ $(n=1, \ldots, N_s)$ by"

▪ Please replace the sixth full paragraph on page 10, lines 30-33, with the following rewritten version:

"Where the element V_{in} is the with component of $f'_{(n)}$ with respect to the unprimed basis. A similar expression exists relating the noise vectors [[ϵ']] $\underline{\epsilon'}$ and [[ϵ]] $\underline{\epsilon}$. Substituting (7) and (8) and (1), we then obtain"

▪ Please replace equation (9) on page 10, line 35, with the following rewritten version:

$$d' = \phi'(s') + [[\epsilon']]\ \underline{\epsilon'}$$

▪ Please replace the first full paragraph on page 12, lines 8-13, with the following rewritten version:

"With a similar expression relating the components of the data vectors d′ and d and the noise vectors [[ϵ]] $\underline{\epsilon}$ and [[ϵ′]] $\underline{\epsilon'}$ (Since the data and signal spaces coincide). Thus, in this case, the N_S-dimensional signal (and data) space has been partitioned into N_S separate disjoint spaces (i.e. one for each Fournier mode)."

▪ Please replace the second full paragraph on page 12, lines 15-29, with the following rewritten version:

"Now for each value of n (or Fournier mode), we may consider the elements d'_n , s'_n and [[ϵ'_n]] $\underline{\epsilon'_n}$ independently of those for other values of n. This leads to a substantial decrease in the CPU time required to de-blur a given image. For simplicity, at our chosen Fournier mode we denote d'_n , s'_n and e'_n by d′ , s′ and [[ϵ′]] $\underline{\epsilon'}$ respectively. The quantity d′ is given simply by the Fournier coefficient of the true underlying image, or signal s′ , multiplied by the Fournier coefficient of the PSF, or response R. In addition, a noise contribution, [[ϵ′]] $\underline{\epsilon'}$, in the Fournier domain may also be present. If is no instrumental errors are expected from a given apparatus, it is still possible to introduce "noise" by, for example, digitizing an image in order to store it on a computer. Thus the data value is given by"

▪ Please replace equation (10) on page 12, line 30, with the following rewritten version:

$$d' = Rs' + \underline{\epsilon'}$$